# Internal/External Surface Finishing of Additively Manufactured IN-625 Components, Phase I

Completed Technology Project (2018 - 2019)

## Project Introduction

The objective of this proposal is to develop a surface finishing technology for Inconel 625 Additive Manufactured (AM) workpieces. The following methodologies will be evaluated and optimized: vibratory finishing, chemical milling and electropolishing. Once optimized, the project will explore combinations of these aforementioned methodologies in order to identify a surface finishing process that can remove 0.02 inches (0.51 mm) of stock in the shortest practical time. The deliverable will be a practical surface finishing procedure that is amenable to commercial industrial scale-up.

Inconel 625 is a nickel-based superalloy that is used in critical aerospace parts that require mechanical strength, resistance to thermal creep deformation, surface stability and resistance to corrosion or oxidation. AM Inconel 625 parts are lighter, can be more complex and consist of fewer components than those made by conventional machining. AM parts, however, suffer from very rough surfaces having initiation sites that lessen their mechanical strength and fatigue properties. A process is urgently needed to reduce the surface roughness so as to eliminate stress raisers in order for the aerospace industries to take full advantage of AM Inconel 625. Currently, there are no known processes to accomplish this proposal's objectives.

## Anticipated Benefits

This technology is applicable to all NASA additively manufactured IN-625 projects requiring improvement to surface finish or mechanical performance including fuel nozzles, missile bodies, rocket skin, nuclear reactor components, turbomachine components, stud supporters, thrust chambers, engine manifolds, and rocket engines. IN-625 components produced by other methods will also benefit from the technology due to surface finish and mechanical performance improvements.

The technology applies to other agencies (including the DoD) and the entire metal-based AM field; industries including aerospace industry, medical devices, automotive/ground vehicle transportation/heavy equipment, energy (nuclear/oil and gas), and industrial machinery are pursuing metal-based AM using alloys such as IN-625. Applications include fuel nozzles, nuclear reactor components, turbomachine components, stud supporters, thrust chambers, engine manifolds, and exhaust components.

## Table of Contents



## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

REM Surface Engineering

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

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**Small Business Innovation Research/Small Business Tech Transfer**

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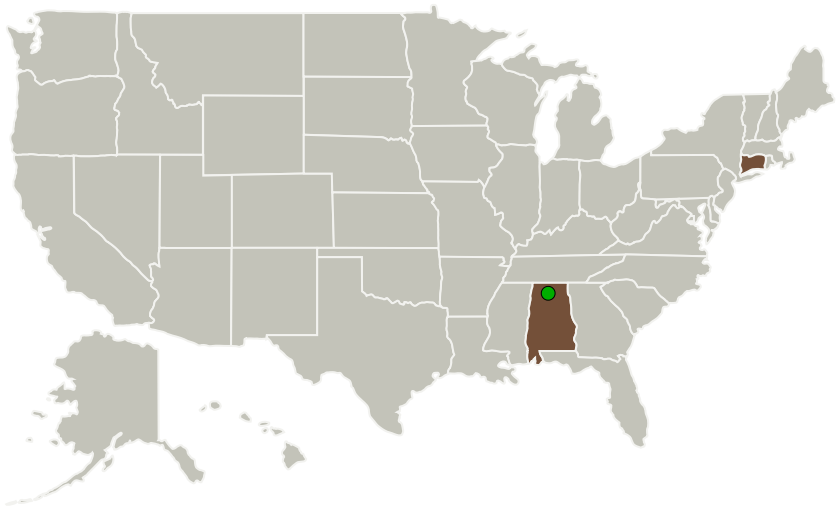
## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| REM Surface Engineering | Lead Organization | Industry | Merrillville, Indiana |
| Marshall Space Flight Center(MSFC) | Supporting Organization | NASA Center | Huntsville, Alabama |

| Primary U.S. Work Locations | |
|---|---|
| Alabama | Connecticut |

## Project Transitions

**July 2018:** Project Start

**February 2019:** Closed out

**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/137846)*

## Project Management *(cont.)*

**Program Manager:**

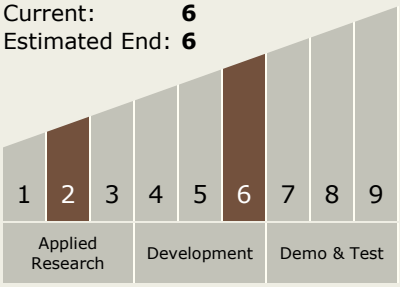
Carlos Torrez

**Principal Investigator:**

Agustin Diaz

## Technology Maturity (TRL)

Start: **2**
Current: **6**
Estimated End: **6**




## Technology Areas

**Primary:**

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

## Target Destinations

Earth, Mars

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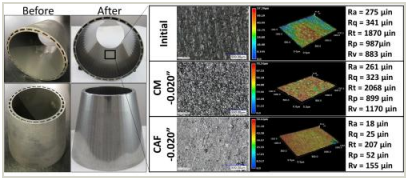
## Images

**Briefing Chart Image**
Internal/External Surface Finishing of Additively Manufactured IN-625 Components, Phase I
*(https://techport.nasa.gov/image/131042)*




**Final Summary Chart Image**
Internal/External Surface Finishing of Additively Manufactured IN-625 Components, Phase I
*(https://techport.nasa.gov/image/130625)*